

## (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
6 May 2004 (06.05.2004)

PCT

(10) International Publication Number  
**WO 2004/038633 A1**

(51) International Patent Classification<sup>7</sup>: **G06F 19/00**

(21) International Application Number:  
PCT/GB2003/004527

(22) International Filing Date: 20 October 2003 (20.10.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
0224626.2 23 October 2002 (23.10.2002) GB

(71) Applicant (for all designated States except US): **QINETIQ LIMITED** (GB/GB); 85 Buckingham Gate, London SW1E 6PD (GB).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **GUITTET, Christelle, Marie** [FR/GB]; Qinetiq Limited, Malvern Technology Centre, E Building Room 304, St Andrews Road,

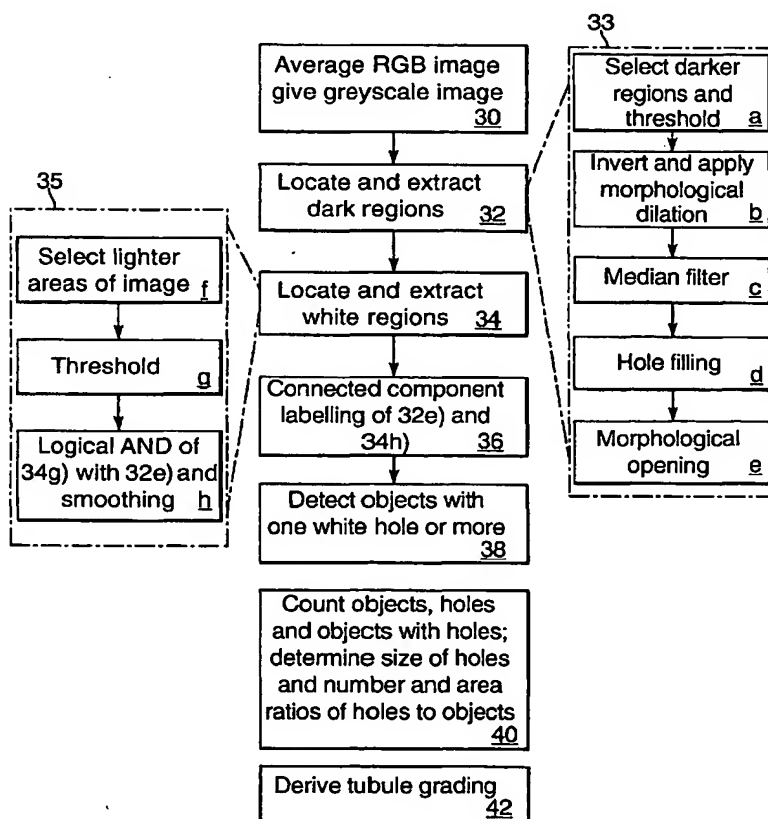
Malvern, Worcestershire WR14 3PS (GB). **VARGA, Margaret, Jal** [CA/GB]; Qinetiq Limited, Malvern Technology Centre, E Building Room 302, St Andrews Road, Malvern, Worcestershire WR14 3PS (GB). **DUCKSBURY, Paul, Gerard** [GB/GB]; Qinetiq Limited, Malvern Technology Centre, E Building Room 311, St Andrews Road, Malvern, Worcestershire WR14 3PS (GB).

(74) Agent: **WILLIAMS, A., W., S.**; IP Qinetiq Fromalities, Cody Technology Park, A4 Building, Room G016, Ively Road, Farnborough, Hampshire GU14 0LX (GB).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

[Continued on next page]

(54) Title: AUTOMATED HISTOLOGICAL GRADING OF TUBULES



(57) **Abstract:** A method of grading tubules in a first histological slide image (50) derives a second image (60) of objects (61) in the first image (50) with boundary characteristics corresponding to tubules. It also derives a third image (70) of second objects (72) in the first image (50) having pixel value characteristic of fat and holes within tubules. It combines data from the second and third images (60, 70) to identify holes (81) within tubules (61) and determines the relative areas of holes (81) as proportions of their tubules (51) to provide ratios, individual tubule ratios and an overall ratio for all holes and tubules collectively. The number of tubules (51) containing appreciably sized holes (52) is counted. Tubules (51) are graded by thresholding based on individual and overall tubule/hole area ratios, tubule/object proportion, tubule number and number of tubules with appreciably sized holes. Thresholds are derived from image gradation by an appropriate medical expert.



(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

— with international search report

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**Declaration under Rule 4.17:**

— of inventorship (Rule 4.17(iv)) for US only